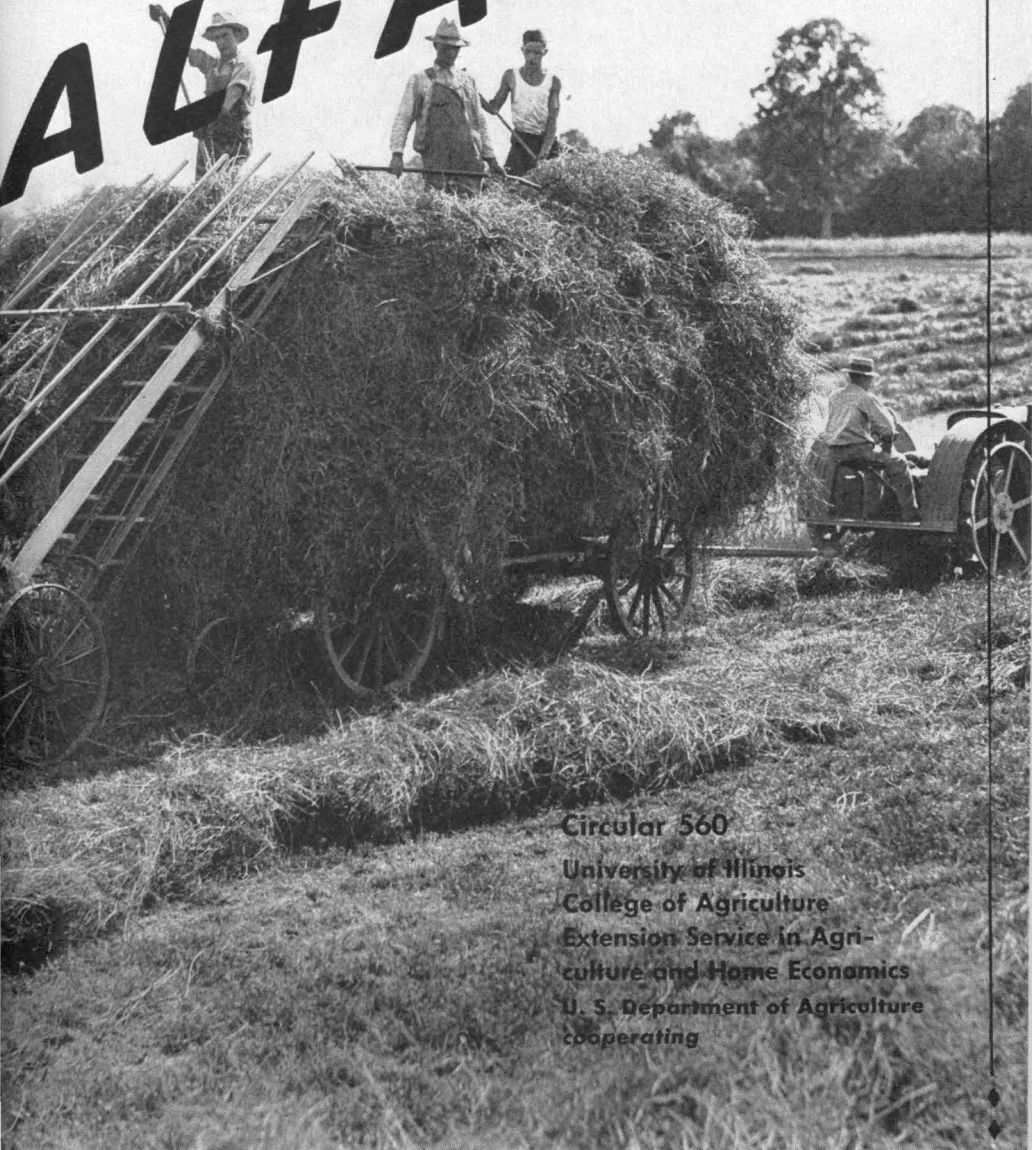


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HOW TO GET GOOD
YIELDS OF—

ALFALFA



Circular 560

University of Illinois

College of Agriculture

Extension Service in Agri-

culture and Home Economics

U. S. Department of Agriculture

cooperating

ILINOIS' BEST ALL-ROUND LEGUME

Keep these points in mind when planting alfalfa:

- Alfalfa cannot grow on sour soils. In fact a few soils can probably never grow it successfully.
- In southern Illinois adapted common alfalfas should be planted; for northern Illinois variegated alfalfas are recommended. Both do well in central Illinois.
- Seed grown in the extreme southwestern states or imported from any foreign country except Canada is not recommended for Illinois.
- Where alfalfa is to be grown for the first time, thoro inoculation must be assured.
- Certain insects and diseases sometimes damage an alfalfa crop and protective measures against them may be needed.
- A first-class seedbed is essential.

HOW TO GET GOOD YIELDS OF ALFALFA¹

By W. L. BURLISON, DAVID HEUSINKVELD, and O. H. SEARS²

ALFALFA IS ONE of the most important forage crops grown in Illinois. It gives a large acre-yield of digestible nutrients high in protein, mineral, and vitamin content and fits well into corn-belt rotations whether it occupies the land for several years or for only one or two years. Alfalfa acreage in Illinois increased from 100,000 acres in 1920 to about 500,000 acres in 1940. In 1942, 588,000 acres were cut for hay alone. Alfalfa production might well be further increased to meet a large part of the legume shortage in this state.

MANY USES FOR ALFALFA

The greater part of the alfalfa acreage in Illinois is cut for hay, but there are many other uses for it—it is grown for pasture, for silage, it is ground into meal, and it is used for soil building. Seed is produced in limited quantities because of the unfavorably humid climate of Illinois, but during seasons of light rainfall the second crop may give good yields of seed.

Superior hay crop. Unsurpassed for general feeding, alfalfa is readily eaten by all kinds of livestock. It is superior in feeding value to grass hays and equal to other legume hays, if not superior to them. Good alfalfa hay is high in protein and minerals, especially calcium, and when well cured is an excellent source of vitamins.

If climatic conditions are normal, three crops of alfalfa hay can be harvested each year. The largest amount of hay is usually produced during the second and third years. Later, various difficulties (winter injury, diseases, poor drainage, acid soil, injurious insects) may combine to reduce the yields.

¹The recommendations made in this Circular are based mainly on cooperative investigations at Urbana, between the Illinois Agricultural Experiment Station and the Division of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture.

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Excellent pasture. The use of alfalfa as pasture is increasing as grazing systems are adopted that do not destroy stands prematurely. Because of its high feeding value and its high carrying capacity after its second year, alfalfa is a superior pasture crop for hogs, sheep, cattle, horses, chickens, and turkeys.

Care should be taken to prevent overgrazing where this crop is expected to remain on the land for more than a year or two. It should not be pastured at all during the first year and only lightly the second year. In the second and following years the young plants should be allowed to grow 10 or 12 inches high before spring grazing is started and then grazing should be light enough to let the plants maintain vigor and productivity.

If early spring grazing is not practiced, the first crop each year (except the first year) may be pastured when it is ready to be cut for hay. Enough livestock to consume the forage in ten days or two weeks should be turned in, because if the alfalfa is allowed to grow for several weeks beyond the hay-cutting stage, it will become stemmy and unpalatable.

Where the land is divided into several fields, alternate grazing is recommended. This practice furnishes the best pasture and also prolongs the life of each field.

Fall grazing should be light enough to permit the plants to reach a height of 10 to 12 inches, for while making this growth they obtain nitrogen and carbon from the air and store these materials in the roots. With this stored material, the plants are more able to survive the winter and start vigorous growth in the spring. After frost, most of the nitrogen and carbon storage has taken place, so somewhat heavier pasturing is safe. However, at least a 5- or 6-inch stubble should be left to protect the roots during the winter.

Horses, mules, and sheep graze closely and are therefore more likely to injure alfalfa than are cattle and hogs.

One disadvantage in pasturing alfalfa with cattle and sheep is that it often causes bloat. It is especially dangerous when young alfalfa is damp, so these animals should not be turned into a field that is wet with rain or dew.

Two other precautions against bloat should be taken: (1) animals should be fed well on nonlegume hay just before they are turned onto an alfalfa field, (2) mixtures of grasses and alfalfa should be used rather than a pure stand of alfalfa, for they are less likely to cause bloat. A combination of brome grass and alfalfa has been used successfully by many Illinois farmers. Besides lessening the danger of bloat, this mixture produces a high yield of good-quality forage.



Alfalfa in a bromegrass-alfalfa mixture in August. The bromegrass was cut for seed in July and later a crop of mixed alfalfa and bromegrass hay was harvested. This 18-inch growth of alfalfa developed after the hay crop was harvested.

Seed crop uncertain in Illinois. In general Illinois farmers should not count on getting a seed crop from their alfalfa altho occasionally a good one may be harvested. Successful production of seed depends upon dry weather, pollinating insects, and freedom from injurious insects.

To obtain a seed crop, the first growth should be cut for hay and the second growth left for seed. If the flowers fall off the second crop without setting pods, the field may still be cut for hay, altho the hay will have a lower feeding value than if cut earlier, or it may be plowed under as green manure.

Harvesting of seed should begin when about 75 percent of the pods have turned brown. The seed can be threshed satisfactorily if the crop is cut and placed in windrows to be picked up by the combine-thresher.

Good silage crop. Silage of high feeding value and good keeping qualities is now being produced with alfalfa by methods developed within recent years. It is being used more each year, especially by dairy farmers. When mixed with green corn or sorghums, or when phosphoric acid or molasses or ground shelled corn is added, alfalfa may be

made into a silage which is superior to corn silage in feeding value because of its higher protein content. Sixty to 80 pounds of molasses, 15 pounds of phosphoric acid, or 80 to 100 pounds of ground shelled corn should be used for each ton of green alfalfa.

Another advantage in using alfalfa for silage is that the crop may be saved in years when unfavorable weather makes it impossible to harvest good-quality hay.

Alfalfa meal gaining in importance. The use of alfalfa meal for hogs and poultry has increased greatly in recent years. It has become an important constituent of commercial feeds as well as of home-mixed feeds. Its high content of minerals and protein make it an excellent hog feed, and its value for poultry lies primarily in the high carotene content. In fact, commercial companies pay for it on the basis of its carotene content.¹

Accessibility of commercial hammer mills and use of home-owned mills has increased the use of alfalfa meal in many localities.

Outstanding soil builder. To understand the full worth of alfalfa in the cropping system, it is necessary to recognize its beneficial effect upon the soil. Being a legume, it can obtain nitrogen from the air, and nitrogen is the most expensive and elusive of all the plant-food elements. Under favorable circumstances a part of this nitrogen will be left in the soil to be used by other crops.

Even when soil conditions or cropping practices prevent an increase in the total nitrogen content of the soil where alfalfa is grown, there is usually an increase in the soil's immediate crop-producing capacity. This stimulating effect is probably due to the rapidity with which the nitrogenous material in the alfalfa residues is transformed into a form of nitrogen that the next crop can take up readily.

Another reason why grain crops yield better after alfalfa may be that the soil where the alfalfa has grown can be more easily worked—it absorbs water more readily, has fewer clods, and on the whole handles better.

REQUIREMENTS FOR A SUCCESSFUL CROP

The successful growing of alfalfa in Illinois depends very largely on proper inoculation, a sweet soil, and good drainage. Adequate nodulation may be secured quite easily, and soil acidity can be corrected by the systematic use of limestone. The drainage problem,

¹Carotene is a material which the animal's body converts into vitamin A.

however, is not so easily solved, and consequently alfalfa is not a good crop for areas of the state where drainage is poor. Soil differences are even more important in Illinois than climatic differences in determining alfalfa yields.

Sweet soil needed. Alfalfa requires more lime than any other common crop except sweet clover. This need is due largely to two conditions: the plant itself takes up more calcium and the nodule bacteria will not survive in very acid soil. Most soils in central and northern Illinois and practically all of the upland soils of southern Illinois require limestone to grow good crops of alfalfa. Even on soils where red clover will grow very satisfactorily, alfalfa often fails unless the soil is limed.

Because of the prevailing acidity of Illinois soils it is desirable, even with the best soils, to know the lime requirement of every field where alfalfa is to be grown.¹ With acidity corrected, both the nodule bacteria and the plant's root system have better conditions for development.

Manure helpful. On soils of low productivity farm manure is of especial benefit to the alfalfa crop. This is largely because of the minerals it supplies. Manure is especially valuable in helping the young alfalfa plant get established because it supplies readily available plant food while the plant is still too small to obtain enough from the soil minerals and the atmosphere.

On sandy soils especially an application of manure, together with lime if it is needed, goes a long way in establishing a good stand of alfalfa.

Phosphate and potash needs vary.² On many Illinois soils the application of phosphates increases alfalfa yields. The lower the amount of available phosphorus in a soil, the greater is the response to phosphate applications. Anyone planning to grow alfalfa should know the quantity of available phosphorus in his soil.

Lack of potassium limits the yield of alfalfa over a wide area in the southern third of Illinois and in smaller areas in the rest of the state.

Inoculation is important. Where there are no alfalfa nodule bacteria in the soil, failure to inoculate usually results in loss of seed, time,

¹See Illinois Circular 346, *Test Your Soil for Acidity*.

²See Illinois Circular 421, *Testing Soil for Available Phosphorus*. For both this circular and for information on testing soil for potash needs, Illinois farmers may consult their farm advisers or write the COLLEGE OF AGRICULTURE, UNIVERSITY OF ILLINOIS, *Urbana*.

and use of the land. Even if a good crop of sweet clover or alfalfa has been grown previously, it is good insurance to inoculate.

Altho the soil method of inoculation is still used occasionally, reliable commercial inoculants sold by most seed dealers are more effective and are now more generally used. Their cost per acre is very small.

VARIETIES FOR ILLINOIS

The value of different alfalfa varieties for Illinois depends largely on their yields of forage and their winter hardiness. In these two characteristics the main variegated alfalfas¹—Grimm, Cossack, Baltic, Hardigan, Ladak, and Ontario—are quite similar. All are noted for their winter hardiness and can be used thruout Illinois.

The common alfalfas,² when adapted to the regions where they are grown, are also very similar in yield of forage. They differ widely, however, in winter hardiness. The farther north the seed has been grown, the more resistant the plants will be to cold.

Domestic seed of a common alfalfa is usually known by the name of the state where it is produced, such as Dakota Common, Montana Common, Kansas Common. Regional strains of imported alfalfas are generally common alfalfas.

Northern Illinois. Variegated alfalfas are better than common alfalfas for northern Illinois. Because of their winter hardiness they yield 5 to 10 percent more than the adapted commons.

Ladak differs somewhat from the other variegated strains in that it is better suited to the cold, dry conditions of the northwestern Great Plains region than to the humid conditions of the regions east of the Mississippi river. It is also unique in that it produces a very heavy first cutting, recovers slowly, and is likely to yield less forage in the second and third cuttings than do the other variegated varieties. Where adapted, its total seasonal yield usually equals or exceeds the yields of other variegated strains.

Common alfalfas grown in the northern and northwestern states are also adapted to northern Illinois altho they are definitely inferior to the variegated strains for this locality. Common strains grown in

¹The predominating flower color of the variegated alfalfas is purple, but brown, blue, greenish-yellow, and smoky flowers are often seen.

²Purple flowers identify the pure common alfalfas. Sometimes variegated flowers are found among the common alfalfas, indicating that they have crossed with variegated strains.

the northern Great Plains region recover more slowly after being cut than do strains produced farther south. Slow recovery indicates an inherent ability for a stand to persist where winter conditions are severe.

A safe rule to follow when using common alfalfa is to plant only seed that has been grown where climatic conditions are *at least as severe* as those where the seed will be planted.



Varieties and strains of alfalfa differ in winter hardiness. The northern strain in the plot on the left survived the winter, but the southern strain of common alfalfa on the right was winterkilled. (*Photo taken at Urbana.*)

For sections of northern Illinois where bacterial wilt is prevalent, a new variety, Ranger, appears promising. This variety has proved both quite resistant to bacterial wilt and equal to adapted varieties in forage production and winter hardiness. However, enough seed has not yet been produced for general use. Seed stocks will be increased as rapidly as possible.

Southern Illinois. Common strains of alfalfa are superior to variegated strains for southern Illinois. Kansas Common and Oklahoma Common are recommended for the southern part of the state. They are more hardy than common strains from the extreme south.

Central Illinois. Both variegated strains and adapted commons do well in central Illinois. The variegated strains are somewhat preferable.

Avoid imported seeds. Imported seed, except that grown in Canada, is not dependable enough for general use in Illinois. In accordance with the Federal Seed Act,¹ alfalfa seed grown in foreign countries, except those of South America and Canada, must be stained 10 percent red. Seed grown in South American countries must be stained 10 percent orange-red; that grown in Canada must be stained 1 percent violet. The inclusion of stained seed is often the only way in which unadapted imported alfalfas can be identified.

Susceptibility to bacterial wilt.² Both variegated and common alfalfas are susceptible to bacterial wilt, and on wilt-infected soils may be severely thinned within two or three years after planting. Under field conditions Cossack has appeared to be somewhat less susceptible to bacterial wilt than Grimm and satisfactory stands occasionally remain a year longer. Ladak was somewhat resistant to bacterial wilt when first introduced from India, but crossing with other alfalfas has weakened this characteristic. Recent tests at the Illinois Station indicate that Ladak has lost much of its original resistance.

Strains of Turkistan origin—Hardistan, Kaw, and Orestan—are highly resistant to bacterial wilt, but in a climate as humid as that of Illinois they are very susceptible to leaf diseases. They can maintain a stand in an area infected by bacterial wilt but lose their leaves because of the leaf diseases; consequently there is usually no advantage in using Hardistan, Kaw, or Orestan in Illinois.

In dry regions where bacterial wilt is prevalent, Turkistan usually outyields other commercial alfalfas, at least over a period of years. Where bacterial wilt is not a problem, Turkistan strains are generally less productive than adapted common and variegated strains.

Because bacterial wilt destroys alfalfa stands in many parts of Illinois, there is increasing need for alfalfas that are resistant to this disease. Ranger, a new variety of alfalfa developed recently by plant breeders, has been tested at many experiment stations and found to be quite resistant to bacterial wilt. However, sufficient seed has not yet been produced for general use. Because Ranger is winter-hardy it is well adapted to the northern half of Illinois.

A wilt-resistant strain with good forage qualities has been devel-

¹The Federal Seed Act became effective in November, 1941.

²For a description of the symptoms and effects of bacterial wilt, see page 14.

oped at the Kansas Station. This strain has not been named nor released and seed is not yet available. It is expected that this strain will be well adapted to the southern half of Illinois.

SEEDING AND HARVESTING

Good seedbed is essential. The failure of many alfalfa crops has been directly traced to a poor seedbed. For a good seedbed the land must be plowed well two or more weeks before seeding and then disked and harrowed until it is firm. This disking and harrowing is particularly necessary for late summer seeding, when lack of moisture may limit growth. A good alfalfa seedbed feels like a thick rug underfoot. Most of the weeds, real enemies of alfalfa, are killed in the preparation of such a seedbed.

Spring seeding gaining favor. For northern Illinois spring seeding is more desirable than seeding in late summer or fall. Where sown in small grain, alfalfa should not be seeded before the last of March. If no nurse crop is used, April and early May seedings can be made successfully on prepared seedbed. Except in southern Illinois, there is danger of losing the alfalfa stand if the alfalfa is seeded after September 1.



A good way to seed alfalfa is to use an alfalfa seed drill. The seed can also be broadcast on a well-prepared seedbed and then covered by a corrugated roller or by a harrow if no roller is available.

In central and southern Illinois the seeding of alfalfa during August has been a common practice, altho spring seeding is more frequent now than formerly. Fall seeding, however, is recommended for southern Illinois. It is also recommended for central Illinois, altho spring seeding has also been successful.



A side-delivery rake helps to get good quality hay because most of the leaves are saved. If the alfalfa is allowed to dry too long in the swath, however, there may be considerable loss of leaves.

The rate of seeding in Illinois varies from 10 to 20 pounds an acre. An average rate of 12 pounds has given good results.

Cultivating does not pay. It is not wise to cultivate alfalfa after the crop has been seeded, altho at one time this practice was recommended.

In experiments with cultivated and uncultivated fields, including cultivation with the spring-tooth harrow and the alfalfa cultivator, the plots not worked over gave slightly higher yields than the cultivated plots. Also some feeders have complained that the hay from cultivated alfalfa fields is dusty and less desirable as forage, especially for horses.

When to cut alfalfa. The best stage for cutting alfalfa depends largely on the season and the location in the state. A reasonably safe rule is to cut the crop after about one-tenth of it is in bloom and before

full bloom. For most years an arbitrary date for cutting will be satisfactory. Such dates are indicated below:

	First cutting	Second cutting	Third cutting
Northern Illinois.....	Second week in June	Third week in July	Not later than September 1
Central Illinois.....	First week in June	Second week in July	Not later than September 10
Southern Illinois.....	Last week in May or first week in June	First week in July	Not later than September 15

Since the leaves of alfalfa contain more nutrients than the stems, as many leaves as possible should be retained during hay-making. Fewer leaves are lost when the hay is made into windrows fairly soon after cutting. In good hay-making weather alfalfa can be cut in the morning and raked into windrows in the afternoon. The next morning after the dew is off, the alfalfa can be turned with the side-delivery rake and then stacked or baled as soon as the hay is dry enough to do so.

Baling directly from the windrow is satisfactory provided the hay is thoroly dry. Alfalfa hay is too valuable to ruin by baling it too green.

ALFALFA DISEASES¹

Alfalfa is subject to a number of diseases. The most important in Illinois are the leaf-spot diseases and bacterial wilt.

Leaf-spot diseases. These are the most common of the alfalfa diseases, occurring to some extent in every alfalfa field every season.

One of these leaf-spot diseases, commonly known as *leaf spot*, is caused by the fungus *Pseudopeziza medicaginis*. Small circular dark-brown spots up to $\frac{1}{8}$ inch in diameter appear on the leaves. When there are many of these spots, growth is checked, and in severe cases the leaves, especially the lower ones, drop off. This disease is most likely to be prevalent in warm, dry weather after the first cutting has been made.

Yellow leaf blotch is probably the second most important alfalfa-leaf disease in Illinois. It is most prevalent in damp, cool weather. It starts as irregularly shaped yellow blotches on which black specks soon develop. Under weather conditions favorable for the disease, the yellow

¹The material in this section has been contributed by BENJAMIN KOEHLER, Chief in Crop Pathology.

color becomes very pronounced, and in advanced stages some of the leaves become almost black. It is caused by the fungus *Pyrenopeziza medicaginis*.

There are a number of other leaf-spot diseases which are usually less important, tho under some conditions they may cause trouble.

Control. The best way to control leaf spot is to keep the soil in a good state of productivity. On productive soils under Illinois conditions the plants grow and produce new leaves faster than the fungus can destroy them and so little serious damage results. On poor soils this disease may soon bring growth to a standstill. The cut crop will then have a high proportion of stems because the leaves, which are the most valuable part of the crop, are underdeveloped or have dropped off.

When leaf diseases are abundant, the crop should usually be cut early, even before it has begun to bloom. At this time the infected leaves have not yet fallen, and thus nearly all the infected material is removed from the field and the next growth has less chance of becoming infected. This procedure, however, should be carried out only when the disease is very severe, for early cutting is likely to result in winter injury.

Bacterial wilt.¹ This disease has appeared in most counties of Illinois and in some localities has infected more than half the fields. Stunted growth is the first conspicuous symptom of infected plants. The stems are slender, and the leaves are light green and considerably smaller than normal. When a wilt-infected plant is dug up and the root is cut crosswise, a yellow ring shows beneath the bark. The deeper the color and the wider the ring, the more severe is the disease. There is a rot that often occurs in the center of the roots which has no connection with bacterial wilt.²

Bacterial wilt is spread from infected plants to healthy plants by harvesting machinery (especially the mower), by drainage water, and probably in other ways. Plants showing symptoms of this disease on the above-ground parts in the fall seldom, if ever, live thru the winter.

The first time wilt occurs in a field it usually does not show up until the stand is two years old. When, however, an infected field is plowed under and reseeded to alfalfa without an intervening crop, the disease

¹For a discussion of strains that are resistant and that are susceptible to bacterial wilt, see page 10.

²In plants three years old or older, the heartwood is low in vitality and easily invaded and rotted by organisms that cannot attack the thrifty parts. Altho certain kinds of "heart rot" appear to hasten the death of plants at times, ordinarily they are not important.

may become prominent in one year. Thus bacterial wilt develops rather slowly, but it cannot be checked once it has gained a start in any of the alfalfa strains now in common use in Illinois. Sooner or later it ruins the field.

What to do. Where bacterial wilt becomes conspicuous and widely distributed, the field should be planted to some crop other than alfalfa the following year. On soil where the disease has occurred, alfalfa should not be seeded for several years, at least not until all the residues from previous alfalfa crops have disappeared.

After bacterial wilt becomes established in a field, it is difficult to keep it out of surrounding areas. But there is still a possibility that alfalfa can be grown successfully in the surrounding fields for two years, but not more than that, if it is included in a short rotation.

INSECT PESTS OF ALFALFA¹

Alfalfa is affected by insects at three times during its life, and at least three insects may do considerable damage to it.

Alfalfa webworm (*Loxostege commixtalis* (Walk.)). New fall plantings of alfalfa are often severely damaged by this insect or killed outright; spring seedlings are not harmed. The insect lives in a webbed-up crack or hole in the ground and emerges during nights and dark days to feed. It frequently builds a web around the plant.

Because attack by webworms is sudden and severe, new seedlings should be closely watched and control measures applied immediately. Dusts or sprays of lead or calcium arsenate give effective control. A dust can be made by mixing 10 pounds of either lead or calcium arsenate with 100 pounds of hydrated lime for each acre to be treated. Dust the plants when dew is on them, because then the dust will stick. A spray made with 4 pounds of either lead or calcium arsenate and 8 pounds of hydrated lime in 100 gallons of water for each acre is also effective.

Clover leaf weevil (*Hypera punctata* (F.)). This weevil does not usually cause serious damage to alfalfa because the plant rapidly outgrows the attack. No cases of the destruction of an alfalfa crop by this weevil are known. The larvae feed on the leaves early in the spring, making small holes in them or eating away small parts of their edges.

¹This section was prepared by J. H. BIGGER, Associate Entomologist, and M. D. FARRAR, Research Entomologist, Illinois State Natural History Survey, Urbana.

Leafhoppers (*Empoasca fabae* (Harris)). These insects puncture the leaves of alfalfa, causing them to turn yellow, and they also stop the growth of the stems and cause the plants to wither. Young stands sometimes are killed outright.

Because growth ceases almost entirely after an alfalfa patch has turned yellow, it is best to cut the crop regardless of its stage of growth. The new crop will very often develop quite normally, the leafhoppers for the most part having apparently disappeared in the meantime. Cutting before the normal time, however, should be done only when the "yellows" condition is severe.

Where only part of a field is markedly yellow, the condition is the result of intensive feeding by hoppers that have migrated from freshly cut areas to uncut areas or into areas that have been cut but where the new plants have made some growth, thus offering attractive feeding. The part of the field that has been deserted by the leafhoppers will come up green and stay green unless it is reinfested.

Leafhoppers are light green and about $\frac{1}{8}$ inch long. When the alfalfa foliage is disturbed in fields where they are abundant, they can be seen flying and jumping about.